

CLAIMS

What is claimed is:

- 5 1. A method comprising:
forming a dielectric overlying a substrate of a wafer, wherein the forming
the dielectric further comprises:
forming a low K dielectric layer overlying the substrate by a
chemical vapor deposition (CVD) process using a silicon
10 precursor, wherein a dielectric constant of the low K dielectric
layer is less than 3.0;
forming a second dielectric layer overlying the low K dielectric
layer by a CVD process using the silicon precursor;
forming a void in the dielectric including in the low K dielectric layer
15 and the second dielectric layer;
depositing a material over the wafer including depositing the material in
the void;
removing portions of the material exterior to the void by polishing the
wafer with a chemical mechanical polishing (CMP) process
20 wherein the polishing removes at least some of the second
dielectric layer.
2. The method of claim 1 wherein the silicon precursor includes a
OctaMethylCycloTetraSiloxane(OMCTS) material.
3. The method of claim 1 wherein the silicon precursor includes a
25 TetraMethylCycloTetraSiloxane(TMCTS) material.

4. The method of claim 1 wherein the silicon precursor includes molecules having a cyclic siloxane structure.

5. The method of claim 1 wherein the forming the low K dielectric layer and the forming the second dielectric layer includes maintaining continuous
5 plasma using the silicon precursor.

6. The method of claim 5 wherein the maintaining the continuous plasma further includes providing plasma using the silicon precursor and oxygen at a first ratio of silicon precursor to oxygen during the forming the low K dielectric layer and providing plasma using the silicon precursor and oxygen at a second
10 ratio of silicon precursor to oxygen during the forming the second dielectric layer, wherein the first ratio is greater than the second ratio.

7. The method of claim 1 wherein:
the forming the low K dielectric layer includes providing plasma using
the silicon precursor and oxygen at a first ratio of silicon precursor
15 to oxygen;
wherein the forming the second dielectric layer includes providing
plasma using the silicon precursor and oxygen at a second ratio of
silicon precursor to oxygen;
wherein the first ratio is greater than the second ratio.

20 8. The method of claim 7 wherein the first ratio is greater than or equal to 2 milligrams per minute of silicon precursor to 1 standard cubic centimeter of oxygen.

9. The method of claim 7 wherein the second ratio is less than or equal to 1 milligram per minute of silicon precursor to 1 standard cubic centimeter of oxygen.
10. The method of claim 1 wherein the low K dielectric layer has a dielectric
5 constant of less than 2.8.
11. The method of claim 1 wherein the low K dielectric layer has a thickness of 2000 Angstroms or greater.
12. The method of claim 1 wherein the chemical vapor deposition (CVD) process used in forming the low K dielectric layer includes is performed with a
10 deposition in a range of 4-10 Torr.
13. The method of claim 1 wherein no K value degrading processes are performed on the low K dielectric layer prior to the forming the second dielectric layer.
14. The method of claim 1 wherein the material is a conductive material.
15. 15. The method of claim 1 wherein the low K dielectric layer is formed on a surface of the wafer including on conductive material and on another dielectric.
16. The method of claim 1 wherein the second layer has a hardness and the low K dielectric layer has a hardness, wherein the hardness of the second dielectric layer is greater than the hardness of the low K dielectric layer.
- 20 17. The method of claim 1 wherein a portion of the second dielectric layer remains after the removing portions of the material exterior to the void.

18. A method of making a dielectric comprising:

forming a low K dielectric layer overlying a wafer substrate by a
chemical vapor deposition (CVD) that includes providing plasma
using a silicon precursor and oxygen at a first ratio of silicon
precursor to oxygen, the silicon precursor including at least one of
a OctaMethylCycloTetraSiloxane(OMCTS) material and a
TetraMethylCycloTetraSiloxane(TMCTS) material, wherein a
dielectric constant of the low K dielectric layer is less than 3.0, and
forming a second dielectric layer on the low K dielectric layer by a CVD
process that includes providing plasma using the silicon precursor
and oxygen at a second ratio of silicon precursor to oxygen;
wherein the first ratio is greater than the second ratio.

19. The method of claim 18 wherein the first ratio is greater than or equal to
2 milligrams per minute of silicon precursor to 1 standard cubic centimeter of
oxygen.

20. The method of claim 18 wherein the second ratio is less than or equal to
1 milligrams per minute of silicon precursor to 1 standard cubic centimeter of
oxygen.

21. A semiconductor device comprising:

a substrate;
an interconnect overlying the substrate, the interconnect comprising:
a dielectric overlying the substrate, the dielectric including a low K
dielectric layer and a second dielectric layer overlying the
low K dielectric layer, the low K dielectric layer having a

dielectric constant of less than 3.0, the second dielectric layer having a silicon to carbon intensity ratio of less than about 175 to 1 by time of flight secondary ion mass spectroscopy; and

5 a conductive interconnect structure located in a void of the dielectric, the void including a void in the low K dielectric layer and a void in the second dielectric layer; wherein the second dielectric layer and the conductive interconnect structure each have a surface substantially coplanar with
10 each other.

22. A method comprising:

forming a dielectric overlying a substrate of a wafer, wherein the forming the dielectric further comprises:

forming a low K dielectric layer overlying the substrate by a
15 chemical vapor deposition (CVD) that includes providing plasma using a silicon precursor and oxygen at a first ratio of silicon precursor to oxygen, the silicon precursor including at least one of a OctaMethylCycloTetraSiloxane(OMCTS) material and a TetraMethylCycloTetraSiloxane(TMCTS)
20 material;

forming a second dielectric layer overlying the low K dielectric layer by a CVD process that includes providing plasma using the silicon precursor and oxygen at a second ratio of silicon precursor to oxygen;

25 wherein the first ratio is greater than the second ratio;

forming a void in the dielectric including in the low K dielectric layer
and the second dielectric layer;
depositing a material over the wafer including depositing the material in
the void; and

- 5 removing portions of the material exterior to the void by polishing the
wafer with a chemical mechanical polishing (CMP) process
wherein the polishing removes at least some of the second
dielectric layer.